

and were dispersed over it by hurricane action. The Bay of Florida is shaped something like a blunt cow's horn, its southern shore being the Florida Keys and the northern one the lower edge of the mainland, while its wide base opens to the west. Whenever, during one of these great storms the wind blows from a westerly direction the water of the sea is driven into the bay with great force and it overflows the entire lower portion of the mainland, *often to a depth of six or seven feet!* Trees growing in this region and bearing *Liguus* or *Oxystyla* are broken off or they may be uprooted and with their living freight swept along on the angry flood in any direction, perhaps, sometimes for several miles. The snails are able to cling to the branches on which they live and to stand immersion in water for many hours. Finally when the storm ceases and the water goes down they are landed in a new place, probably a hammock where it is easy for them to crawl off, climb the nearest tree and at once establish a new colony. This will account for the fact that one hammock will have one or more species, the next another lot and a third nearby no *Liguus* at all. The hurricanes are hit and miss sowers.

VARIATIONS IN *GONIOBASIS* EDGARIANA LEA.

BY CALVIN GOODRICH.

Caney Fork, Tenn., a branch of the Cumberland river, supplied Lea with several of his types of *Pleuroceridae* and Anthony with at least two of his. Associated with the early collections from the stream are the names of Sellers, Edgar and Troost which one comes upon frequently in the literature of American freshwater mollusks. A probable fourth visitor to Caney Fork was Safford, who appears to have lived at Lebanon, not far from this river. Wetherby touched at one spot in the drainage in the 1870's. I suspect that I was the next conchologist there, collecting between rains and floods in 1920. The year following, with a merciless sun to contend with instead of high waters, Miss Mina Winslow made an admirable collection. Dr. Ortmann did still more work in the stream in 1922.

Caney Forks drains a section of the western escarpment of the Cumberland mountains. One tributary, Calfkiller river, follows a broad valley at the base of the highlands. Collins river, a second branch of many forks, approaches Walden Ridge toward the southeast and issues in the southwest from the ridge upon whose further side is the Duck river.

The characteristic univalve of the drainage is *Goniobasis edgariana* Lea, ranging closely to *G. laqueata* Say and only remotely, it seems to me, to *G. nassula* Conrad, under which Tryon consigned *edgariana* as a synonym. It is a large shell for the genus, typically striate-plicate, with flattened whorls and a subangular base in immature specimens. Studies of the variations by localities brought out the following facts:

Calfkiller river, at Calfkiller, Putnam County—This is within four or five miles of the beginning of the stream and is apparently the highest spot reached by shell life. Of 580 specimens taken, 85 per cent has the plicate sculpture only. The remaining 15 per cent are plicate-striate. The sculpture ceases when the shell is about half-grown and thereafter consists only of nearly microscopic growth-lines. It is convenient to speak of that appearance as smooth. Only two shells were found with indications of color bands. In respect to color and texture, the shape of the aperture and the form of the outer lip, the shells correspond to typical *edgariana*.

Town creek, a branch of Calfkiller river, near Sparta, White County—Collections made by Miss Winslow, about 325 shells. The typical plicate-striate sculpture is present in 69 per cent. As the shells grow the plicae tend to disappear. In the case of 89 specimens, the last whorl is striate only, in all it is smooth. Both adults and young are included in this count and it might be explained that the sculpture is persistent in nearly all the full-grown examples and wholly absent only in a few. Two shells are plicate without having the revolving striae. Dr. Ortman's collection at this locality did not differ from Miss Winslow's.

Two shells in my collection labeled simply "Calfkiller river" and a single lot in Dr. Walker's cabinet, similarly designated and carrying Wetherby's identification, *G. caliginosa* Lea, are of this form.

Barren Fork, branch of Collins river, McMinnville, Warren County—Thirteen shells taken by Wetherby. Eleven adult and nearly adult specimens are plicate-striate to the last whorl. Two retain only the revolving striae upon this whorl. These are more nearly like the types, credited to Caney Fork proper, than any *edgariana* from the main stream I have seen outside of the Lea collection. Dr. Ortmann's shells from this place were so like Wetherby's that I have not studied them intensively. An interesting note made by Dr. Ortmann was that the young *edgariana* he found here were in a shallow branch.

Hickory creek, branch of Barren Fork, two miles south of McMinnville—156 shells, almost all adult. Except three, these specimens are plicate-striate from apex to base of last whorl. The three are striate, but not plicate, on the ultimate whorl.

Caney Fork, Riverhill, White County—45 shells taken by Dr. Ortmann. Thirty-seven shells have plicate-striate apex, six are only plicate at the apex; two specimens are so eroded that the sculpture cannot be made out. In the case of 21 examples, the base is more or less distinctly striate; the base in 24 is smooth. None is plicate to the last whorl as is common with the *edgariana* from Barren Fork and Hickory creek. This is a rough, heavy lot, tending apparently to lose the distinctive sculpture of the species.

Caney Fork, below dam at Falls City, Warren County—270 shells taken by Miss Winslow. The specimens plicate-striate to the last whorl amount to 80 per cent, but not one is adult. Even in the instance of the young shells, there is a slight tendency for the plicae to become obsolete. Fourteen are striate on the last whorl, six are smooth. Of the full-grown individuals, 13 are striate to the base, 22 are smooth upon the last whorl. The material of two other lots, collectors unknown, correspond to this form.

Butts creek, DeKalb County—Nineteen shells. Here the plicate-striate sculpture is confined entirely to the early whorls and in one example the apex is striate only. The last whorls of all the shells are smooth. These mollusks seem to be identical with *Melania columella* Lea.

The species occurs also in Stone's river, Rutherford County,

Tenn., another tributary of the Cumberland. It has been taken there by Wetherby and Ortmann. The shells are more convex than the Caney Fork forms, the revolving striae are stronger and more persistent, the last whorls of some of the young are rounded rather than subangular. Of 26 shells of a lot in Dr. Walker's collection, 24 are plicate-striate on all whorls. In two specimens, the plicae have disappeared before the last whorl is reached. The Stone's river form corresponds with *Melania corrugata* Lea.

While nearly every colony of *edgariana* varies from other colonies, it does not, as in the case of *Io*, vary with reference to any particular position in the stream. The most elaborately sculptured forms occur in Calfkiller river, presumably after the river stage is reached; in a branch of this stream and in branches of Collins river. A more simple form lives in the headwaters of Calfkiller river and the tendency of the species in Caney Fork at Riverhill and at the falls is toward simplification. That environment has an influence in this matter is not clear, for Barren Fork, at the time I saw it, was swift and rough; Hickory creek, having the same form of *edgariana*, was a slow-moving stream. Conditions in the upper Calfkiller river and those at the falls of Caney Fork would correspond only at a time of freshet.

The habitat in upper Calfkiller river was clear, gently-flowing water, six to eighteen inches deep. The shells occurred in all parts of the stream, upon stones and a small sandbar. In Hickory creek, nearly all *edgariana* were taken from limestone rocks exposed by the channel. While Barren Fork, just below, was on a rampage, Hickory creek had the current of a prairie brook. So I judge it is seldom swift. Dr. Ortmann writes that at Riverhill, the shells occurred "in riffles, on rocks; also in slowly flowing water along banks, on mud." The habitat at McMinnville, he describes as "riffles with coarse gravel; the very small ones were found in a shallow branch among fine gravel." In Town creek, he found the shells "in quiet pools and eddies on mud and sand as well as on ridges of limestone crossing the creek."

The synonymy of this species is:

Melania edgariana Lea, March, 1841.

Melania columella Lea, March, 1841.

Melania caliginosa Lea, March, 1841.

Melania concinna Lea, March, 1841.

Melania corrugata Lea, March, 1841.

Melania rugosa Lea, Dec., 1842.

Melania coricina Anth., Dec., 1850.

Melania sellersiana Lea, 1852.

Goniobasis purpurella Lea, May, 1862.

Pillsbry* has made *M. corrugata* and *rugosa* synonyms of *G. laqueata* Say. As *edgariana* is a sort of robust stepbrother of *laqueata* the transfer I have suggested in the position of the two species is of no great importance.

**ASHMUNELLA HEBARDI, A NEW SNAIL FROM THE HACHETA GRANDE
MOUNTAINS, NEW MEXICO.**

BY H. A. PILSBRY AND E. G. VANATTA.

In his summer campaign for Orthoptera in company with Mr. Rehn, Mr. Morgan Hebard visited the northwestern slope of Hacheta Grande. Ascending in a broad canyon, he found landshells at about 7600 ft. *Holospira crossi* Dall and *Oreohelix hachetana* Pils. do not differ from the specimens already known from about a thousand feet higher, at the summit of the mountain, where one of us collected in 1910. The *Ashmunella* obtained, while related to *A. mearnsi*, is rather conspicuously distinct.

ASHMUNELLA HEBARDI n. sp. Shell of about the size and color of *A. mearnsi*, but differing (1) by the presence of an acute peripheral keel near the top of the whorl, the upper surface of the last 3 whorls nearly flat, the last whorl impressed above the keel; the base strongly convex, (2) the straight parietal callus is much more strongly raised, (3) the surface is distinctly

* Proc. Acad. Nat. Sci., Phila., 1896, p. 499.